

Three new caespitose species of *Senecio* (Asteraceae, Senecioneae) from South Peru

Daniel B. Montesinos Tubée^{1,2,3}

1 Nature Conservation & Plant Ecology Group, Wageningen University, Netherlands. Droevendaalsesteeg 3a, 6708PB Wageningen, The Netherlands **2** Naturalis Biodiversity Centre, Botany Section, National Herbarium of The Netherlands, Herbarium Vadense. Darwinweg 2, 2333 CR Leiden, The Netherlands **3** Instituto Científico Michael Owen Dillon, Av. Jorge Chávez 610, Cercado, Arequipa, Perú

Corresponding author: Daniel B. Montesinos Tubée (dbmtperu@gmail.com; daniel.montesinos@wur.nl)

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Abstract

Three new species of the genus *Senecio* (Asteraceae, Senecioneae) belonging to *S.* ser. *Suffruticosi* subser. *Caespitosi* were discovered in the tributaries of the upper Tambo River, Moquegua Department, South Peru. Descriptions, diagnoses and discussions about their distribution, a table with the morphological similarities with other species of *Senecio*, a distribution map, conservation status assessments, and a key to the caespitose Peruvian species of *S.* subser. *Caespitosi* are provided. The new species are *Senecio moqueguensis* Montesinos, **sp. nov.** (Critically Endangered) which most closely resembles *Senecio pucapampaensis* Beltrán, *Senecio sykora* Montesinos, **sp. nov.** (Critically Endangered) which most closely resembles *Senecio gamolepis* Cabrera, and *Senecio tassaensis* Montesinos, **sp. nov.** (Critically Endangered) which most closely resembles *Senecio moqueguensis* Montesinos.

Resumen

Tres nuevas especies del género *Senecio* (Asteraceae, Senecioneae) pertenecientes a *S.* ser. *Suffruticosi* subser. *Caespitosi* fueron descubiertas en las alturas de la cuenca del río Alto Tambo, Departamento Moquegua, Sur de Perú. Las especies se describen y tipifican, una diagnosis y discusión acerca de su distribución, una tabla con las similitudes morfológicas con otras especies de *Senecio*, un mapa de distribución, el estatus de conservación y una clave para las especies peruanas cespitosas de *S.* subser. *Caespitosi* son presentadas. Las nuevas especies son *Senecio moqueguensis* Montesinos, **sp. nov.** (En Peligro Crítico) el cual se asemeja más a *Senecio pucapampaensis* Beltrán, *Senecio sykora* Montesinos, **sp. nov.** (En Peligro Crítico) el cual se asemeja más a *Senecio gamolepis* Cabrera, y *Senecio tassaensis* Montesinos, **sp. nov.** (En Peligro Crítico) el cual se asemeja más a *Senecio moqueguensis* Montesinos.

Keywords

Compositae, new species, *Senecio* subser. *Caespitosi*, South America, taxonomy

Palabras clave

Compositae, nuevas especies, *Senecio* subser. *Caespitosi*, Sudamérica, taxonomía

Introduction

Senecio contains about 175 species in Peru (Brako and Zaruchi 1993, Vision and Dillon 1996) including several recently described new species (Beltrán 2009). The genus has 94 species endemic to Peru which have been evaluated and classified according to IUCN criteria (Beltrán et al. 2007). In the Department of Moquegua, 30 species have been recorded (Arakaki and Cano 2003, Montesinos 2012). The species of *Senecio* described here were discovered in the tributaries of the upper Tambo River in southern Peru, an area of extraordinary species richness and a high level of endemism (Montesinos 2011, 2012).

Senecio ser. *Suffruticosi* Cabrera accounts for 143 species occurring on the American continent, especially in the Andes and Patagonia (Cabrera 1949, Cabrera 1985, Cabrera et al. 1999). Cabrera et al. (1999) divided *S. ser. Suffruticosi* into five subseries and described it as embracing suffruticose or perennial herbs, glabrous or glandulose, with entire leaves which are dentate or, more rarely, incised, involucre discoid, and capitula isomorphic. Among those subseries, *S. subser. Caespitosi* Cabrera contains 50 species (Cabrera et al. 1999), of which thirteen occur in Peru at altitudes between 3500 m and 5000 m (Brako and Zaruchi 1993, Beltrán et al. 2007): *S. adenophyllus* Meyen & Walp., *S. algens* Wedd., *S. scorzonerifolius* Meyen & Walp. and *S. trifurcifolius* Hieron. also distributed in northwestern Argentina, Bolivia and north of Chile, *S. danai* A. Gray and *S. pucapampaensis* Beltrán occurring only in central Peru (Beltrán 2007), *S. evacoides* Sch. Bip., *S. expansus* Wedd. and *S. humillimus* Sch. Bip. also distributed in northwestern Argentina and Bolivia, *S. gamolepis* Cabrera, endemic to central and southern Peru, *S. rufescens* DC. distributed from Colombia to northwestern Argentina, *S. repens* Stokes distributed from south Ecuador through Peru and northwestern Bolivia, and *S. vegetus* (Wedd.) Cabrera, also distributed in Bolivia. In *S. subser. Caespitosi* plants are characterized as suffruticose (or herbaceous), glabrous or glandulose; leaves entire, dentate or, more rarely, incised; capitula discoid, medium or small; and flowers isomorphic (Cabrera et al. 1999).

Notwithstanding the progress in taxonomical and molecular studies (Nordenstam 1977, Cabrera 1949, 1985, Cabrera et al. 1999, Pelser et al. 2007, Nordenstam et al. 2009), there are more species of the tribe *Senecioneae* occurring in the Andes which remain poorly understood and are awaiting discovery. Intergeneric relationships within *Senecioneae* are still largely unknown (Pelser et al. 2007); furthermore, the lack of knowledge about generic-level evolutionary relationships in *Senecioneae* remains the largest taxonomic problem on the way to obtaining a monophyletic delimitation of

Senecio (Bremer 1994, Pelser et al. 2007). Phylogenetic positions for the members of *S.* subser. *Caespitosi* are still largely unknown, except for *S. algens*, *S. humillimus* and *S. rufescens* (Pelser et al. 2007), of which *S. algens* belongs to the *Aetheolaena involucrata*-*A. patens* clade and *S. humillimus* and *S. rufescens* to the *Senecio glaber*-*S. donianus* clade. Numerous new collections from Moquegua have been made in recent years (Montesinos 2011, 2012). A comparison with herbarium specimens, together with a review of the literature and taxonomic keys, has shown that these collections include three new species of *S.* subser. *Caespitosi* which are described below. These new species were separated from the other species of this subseries on the basis of a set of characters such as habit, the presence or absence of trichomes, flower color, the number of phyllaries and involucre bracts, the involucre length and the achene type (Cabrera 1955, 1985, Cabrera et al. 1999). The new species can be found at elevations above 4500 m as terrestrial plants on bare rocky soils on the summits of high mountains in the north of Moquegua department, where they co-occur with several other acaulescent *Senecioneae* from *S.* subser. *Caespitosi* such as *S. gamolepis*, *S. evacoides*, and *S. algens*.

Methods

Based on morphological characters, an overview of the genus *Senecio* with an emphasis on *S.* subser. *Caespitosi* from Peru and adjacent areas (Ecuador, Bolivia, Argentina and northern Chile) has been prepared, based on Cabrera (1955, 1985) and Cabrera et al. (1999). Since 2009 I have examined more than 450 specimens of *S.* subser. *Caespitosi* housed in Peruvian herbaria (CUZ, HSP, HUPCH, HUSA, MOL, USM), relevant collections from institutions abroad (B, BR, F, L, LPB, MO, P, WAG), and material from my recent fieldwork. Digitised specimens were viewed via online herbarium catalogues (<http://tropicos.org> and <http://fm1.fieldmuseum.org/vrrc/>) or via JSTOR (2013). All morphological characters were studied under a NSZ-405 1X-4.5X stereo microscope and an AmScope M100C-LED 40×-1000× compound microscope. The descriptions were made using the terminology presented by Cabrera (1955, 1985), Cabrera et al. (1999), Vision and Dillon (1996), Beltrán (2009), Nordenstam et al. (2009) and Roque et al. (2009). Conservation assessments were undertaken using the IUCN criteria (IUCN 2001).

Taxonomy

***Senecio moqueguensis* Montesinos, sp. nov.**

urn:lsid:ipni.org:names:77140249-1

Figs 1, 4A, 5

Diagnosis. The new species is morphologically similar to *Senecio pucapampaensis* but is clearly distinguished by the leaf lamina oblong-spathulate (vs. cuneiform), leaf surface

covered by thin trichomes (vs. glabrous), corolla yellow (vs. white), calycular bracts linear-oblong, 6–9 mm long (vs. linear, 6–7 mm long), and phyllaries 9–12 (vs. 12–14).

Type. PERU. Moquegua Region, General Sánchez Cerro Province, Ubinas District, NW of Tassa, terrestrial on clayey rocky soils on the plateau peaks near Lake Pacosani, elevation 4653 m, 16°06'43"S, 70°44'45"W, 3 April 2009, *Montesinos 2400* (holotype USM!, isotypes MO 2383567, HUPCH 4185, CPUN, WAG 0246107).

Description. *Perennial* herb, rhizomatous, creeping, low-growing, forming mats 2–4 cm tall and up to 60 cm in diam. *Trichomes* glandular, somewhat dense and irregularly distributed, multicellular, whitish transparent, 0.1–0.3 mm long and 0.05–0.1 mm wide and composed of 4–8 subrotund cells (each 30–50 µm long), apical cell rotund. *Stems* 1–3 cm long, often densely branched and leafy in the central part, rooting. *Leaves* cauline, lamina oblong-spathulate, 8–12 mm × 1–2.5 mm, sparsely covered by thin trichomes on the margins, lower and upper surfaces except at the base; base truncated, apex subpinnatifid; young leaves dark green with yellowish margins, turning light green-greyish with age. *Synflorescences* of solitary sessile or subsessile terminal capitula. *Capitula* homogamous, discoid. *Involucre*s at first broadly cylindrical, gradually turning campanulate with age, ca. 7–10 mm long × 6–8.5 mm wide). *Calycular bracts* linear-oblong (6–9 mm × 1–2.5 mm), whitish green on the surface and whitish along the margins, with scarce trichomes near the midrib and margins, apex dark brown covered with short light-brown trichomes. *Phyllaries* 9–12, connate, 5–8 mm long × 0.7–1.2 mm wide, oblong-lanceolate, covered with thin trichomes sparsely on the surface and densely along the margins, apex greenish grey and dark brown with short white multicellular trichomes. *Florets* 24–28; corolla tubular, abruptly constricted near the base, 5-lobed, each lobe 0.5 mm long, bright yellow, tube 3–5 mm long × 0.8–1 mm wide; anthers linear-lanceolate, 1.5–2.5 mm long, 0.2–0.4 mm wide, ecalcarate, terminal appendages lanceolate, obtuse, margin whitish transparent and becoming yellow towards the centre; style dark yellow, truncate, papillae covering the whole surface of the apex. *Achenes* cylindrical, covered with trichomes, 1.8–2.5 mm long and 0.4–0.8 mm wide, light brown; carpodium symmetrical in a small ring; pappus of smooth bristles, white, silky, 5–6 mm long, with fine single setulae.

Ecology and distribution. Terrestrial plant on clayey rocky soils on the peaks of the highland summits and grasslands in the north of Moquegua Region, at elevations of ca. 4500 to 4800 m. Co-occurring species include *Azorella compacta* Phil., *Calamagrostis vicunarum* (Wedd.) Pilg., *Pycnophyllum molle* Remy, and *Festuca* spp. Flowers and fruits between March and April.

Etymology. The specific epithet refers to Moquegua, where the only three collections are known from the north of the department.

Additional material examined (paratypes). PERU. Moquegua Region, General Sánchez Cerro Province, Ubinas District, terrestrial on bare clayey soils in the verges of the road east Pillone town, elevation 4584 m, 16°10'02"S, 70°49'56"W, 24 March 2013, *Montesinos 4022* (USM, HUSA). Moquegua Region, General Sánchez Cerro Province, Ubinas District, NW of Tassa, terrestrial on bare clayey soils in the verges of

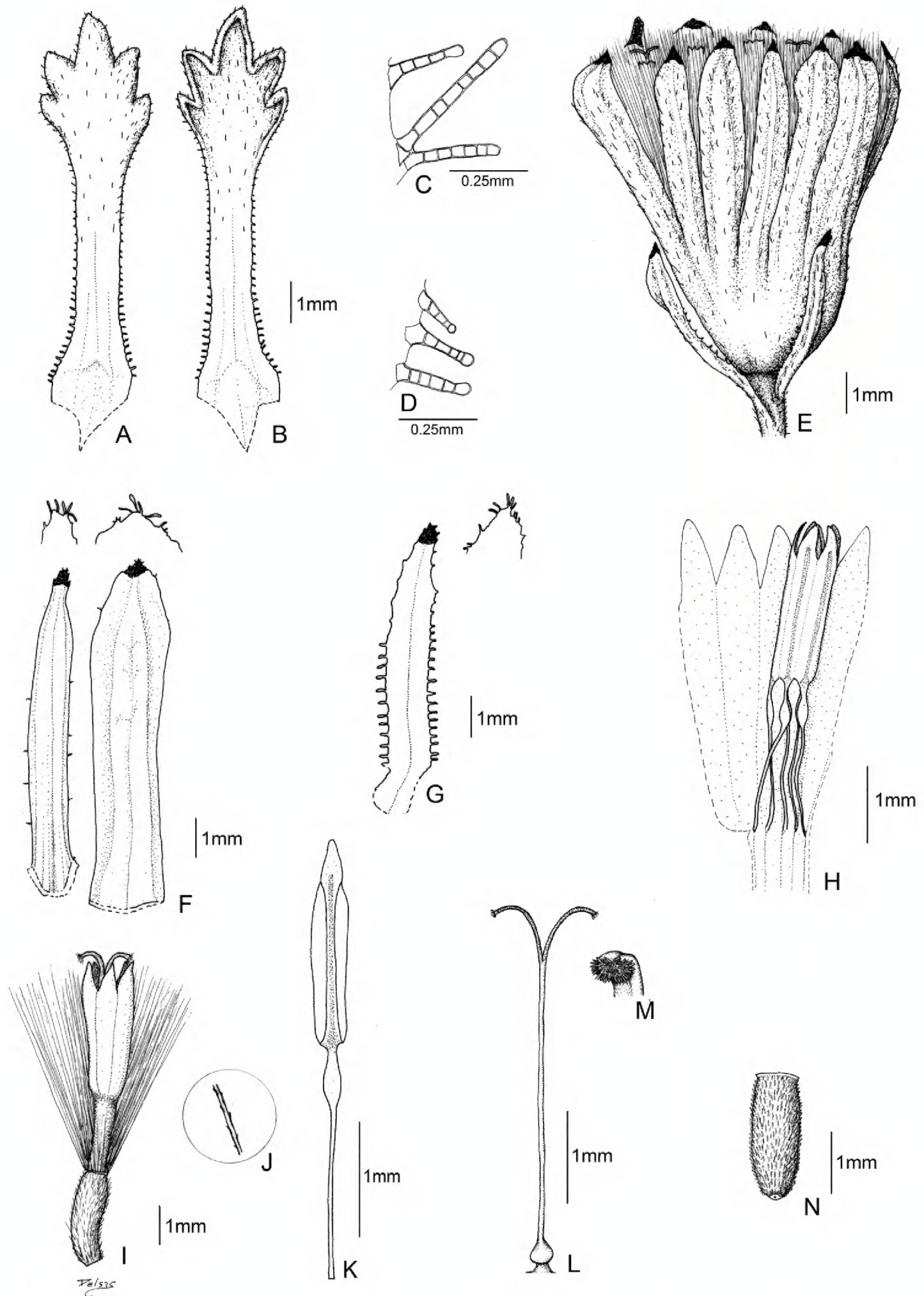


Figure 1. *Senecio moqueguensis* Montesinos. **A** Leaf (upper side) **B** Leaf (underside) **C** Phyllary trichomes **D** Leaf trichomes **E** Capitulum **F** Calycular bracts **G** Phyllary **H** Stamens arrangement in a floret **I** Floret **J** Pappus bristles **K** Stamens **L** Style **M** Papillose stigma **N** Achene

the road to Lake Cochapata, elevation 4687 m, 16°08'56"S, 70°43'0.30"W, 9 December 2013, *Montesinos 4200* (CUZ).

Discussion. A comparison of the material has shown that *S. moqueguensis* is most similar to *S. pucapampaensis* and *S. tassaensis* sp. nov. Together with *S. evacoides*, *S. expansus*, *S. repens* and *S. humillimus*, it forms a coherent morphological and geographical group within *S.* subser. *Caespitosi* which occurs from central Peru to northwest Argentina and is characterized by the presence of trichomes on stems, leaves and involucre. *Senecio moqueguensis* can be distinguished from *S. pucapampaensis* by the dense caespitose mat habit, leaves, calycular bracts, corolla color, involucre and achene morphology as summarised in Table 1. *Senecio moqueguensis* can be distinguished from *S. evacoides*, *S. expansus* and *S. repens* by the habit, density of trichomes, leaf shape and length, as well as by the calycular bracts and phyllary length and form.

Conservation status. Following the criteria and categories of IUCN (2001), a preliminary status of Critically Endangered (CR) is assigned. The new species deserves protection because its total area of occupancy is less than 100 km² (ca. 50 km²) (B1); only three populations are known (B1b); habitat inferred to be continuing to decline (B1b(i-iii)); population estimated to number fewer than 300 individuals (D). The suitable habitats for *S. moqueguensis* on the mountain summits near the set of lakes in the Ubinas district are regarded as endangered because overgrazing of grasslands, changes in annual rainfall, volcanic activity, and exploitation of natural resources may all potentially reduce their extent.

***Senecio sykora* Montesinos, sp. nov.**

urn:lsid:ipni.org:names:77140250-1

Figs 2, 4B, 5

Diagnosis. Morphologically similar to *Senecio gamolepis* but clearly distinguished by the tuft mat habit (vs. cushion mats), the leaf shape being obovate-spathulate (vs. linear-lanceolate), corolla white (vs. yellow), phyllaries 12–14 (vs. 7–9), disc length 7–9 mm (vs. 8–12 mm), and achene length 1.5–2 mm (vs. 1–1.3 mm).

Type. PERU: Moquegua Region, General Sánchez Cerro Province, Yunga District, E of Yunga, terrestrial on bare clayey soils on the peaks of Perusa mountain, elevation 4802 m, 16°11'08"S, 70°38'14"W, 13 April 2012, *Montesinos & Calisaya 3805* (holotype USM!, isotype HUSA!).

Description. *Perennial* herb, decumbent, low-growing and forming small tuft mats 4–6 cm high and up to 6 cm in diam. *Trichomes* absent. *Stems* 3–5 cm long, densely leafy, woody and branched at the base. *Leaves* cauline, alternate, lamina obovate-spathulate, 9–14 mm long × 1–2.2 mm wide, glabrous on surface and margins except at the base (scarcely covered by thin, short trichomes), base truncate to auriculate, apex obtuse, entire, margin involute; young leaves pale green with yellowish margins turning dark green with age. *Synflorescences* of solitary, terminal capitula. *Capitula*

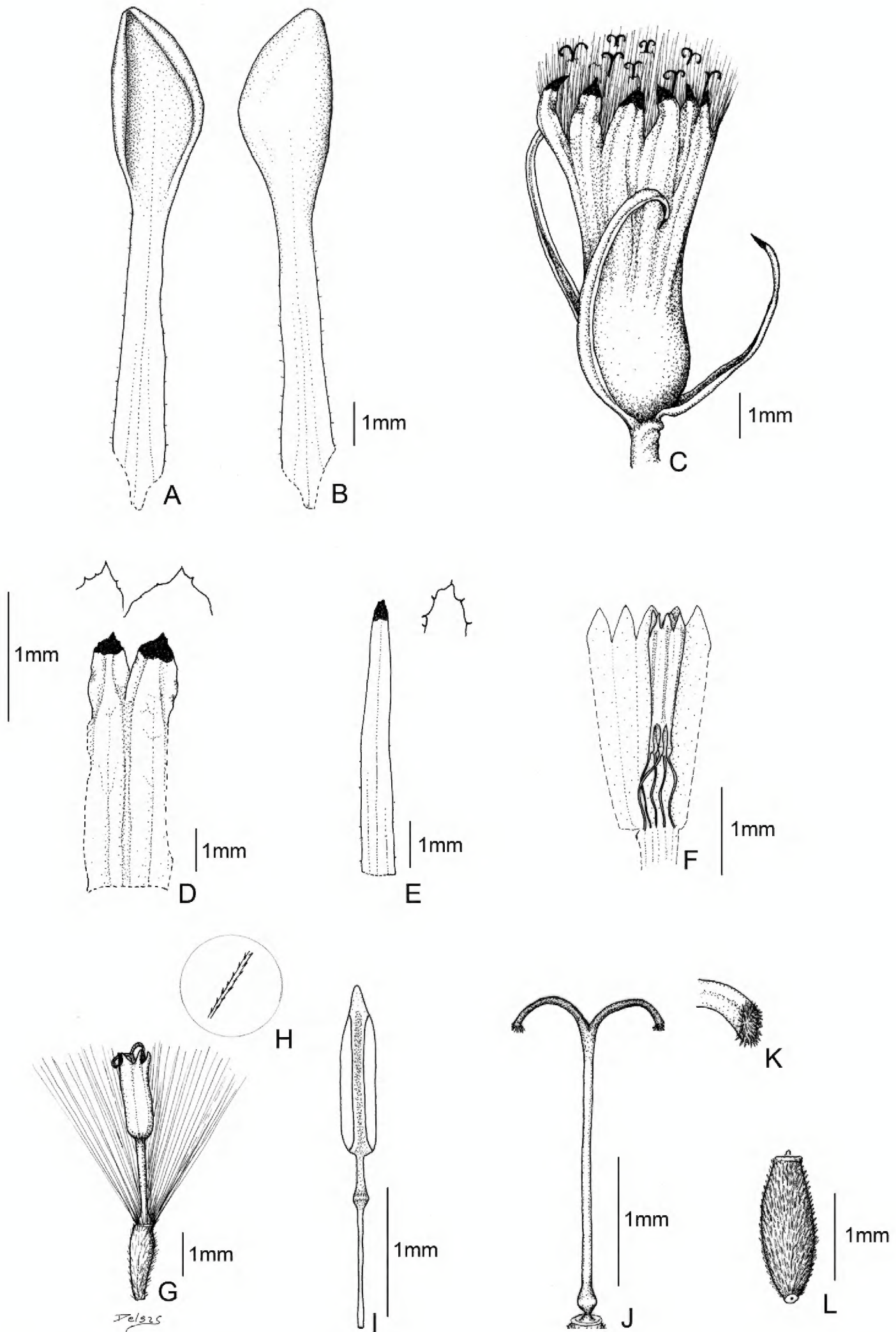


Figure 2. *Senecio sykoraе* Montesinos. **A** Leaf (upper side) **B** Leaf (underside) **C** Capitulum **D** Calycular bracts **E** Phyllary **F** Stamens arrangement in a floret **G** Floret **H** Pappus bristles **I** Stamens **J** Style **K** Papillose stigma **L** Achene

Table 1. Comparison between *Senecio moqueguensis*, *S. sykora*, *S. tassaensis* and their closest relatives.

	<i>S. moqueguensis</i>	<i>S. sykora</i>	<i>S. tassaensis</i>	<i>S. pucapampaensis</i>	<i>S. gamolepis</i>	<i>S. algens</i>
Distribution	PE (Moquegua)	PE (Moquegua)	PE (Moquegua)	PE (Junin)	PE, CH, AR, BO	PE, BO, AR
Altitude	4500–4800 m	4550–4800 m	4650–4700 m	4500–4600 m	4000–4800 m	4500–5000 m
Habit	dense caespitose mat	tuft mat	tuft	postrate, decumbent	dense caespitose mat	caespitose subshrub
Plant dimensions (height, diameter)	2–4 cm, > 60 cm	4–6 cm, > 6 cm	2–4 cm, > 4 cm	5–9 cm, > 8 cm	2–3 cm, > 1 m	4–6 cm, > 6 cm
Indumentum	glandular, multicellular, 0.1–0.3 mm	absent	glandular, multicellular, 0.3–1.2 mm	finely puberulous, <0.1 mm	absent	absent
Leaf shape	oblong-spathulate, subpinnatifid	obovate-spathulate	obovate-spathulate, incised or acuminate	cuneiform-subpinnatifid, incised	linear-lanceolate	spathulate, obtuse
Leaf (length, width)	8–12 × 1–2.5 mm	9–14 × 1–2.2 mm	6–9 × 1–2.5 mm	9–15 × 3–4 mm	8–12 × 2–4 mm	10–35 × 2–5 mm
Leaf pubescence	sparsely covered by thin trichomes	glabrous	densely covered by trichomes	ciliate margins	glabrous	glabrous
Involucre (shape; length; width)	cylindrical-campanulate; 7–10 × 6–8.5 mm	cylindrical-campanulate; 7–9 × 3–5 mm	cylindrical-campanulate; 6–8 × 5–7 mm	campanulate; 7–8 × 8–9 mm	cylindrical-campanulate; 8–11 × 4–6 mm	cylindrical-campanulate; 7.5–10 × 8–12 mm
Calycular bracts (shape; margin; size)	linear-oblong; sparse trichomes; 6–9 × 1–2.5 mm	linear-oblong; scarce trichomes; 6–8 × 0.7–1 mm	ovate-oblong; dense trichomes; 4–6 × 1 mm	linear; ciliate; 6–7 × 1 mm	linear; glabrous; 7–10 × 0.8–1.2 mm	linear; glabrous; 6–9 × 0.8–1.1 mm
Phyllaries (shape; size)	oblong-lanceolate; 5–8 × 0.7–1.2 mm	linear-lanceolate; 5–6.5 × 0.6–1 mm	linear-lanceolate; 5–8 × 0.8–1.2 mm	linear; 6–7 × 1.2 mm	oblong; 6–8 × 1.8–2.3 mm	linear; 7–9 × 2–3 mm
Phyllaries (number)	9–12	12–14	12–16	12–14	7–9	10–15
Phyllaries (margins)	densely covered with trichomes	glabrous	densely covered with trichomes	scarios, ciliate	glabrous	glabrous
Corolla (color)	bright yellow	white	purple-pink to pale white	white	yellow	yellow
Achene (shape, texture)	cylindrical, with trichomes	cylindrical, with trichomes	ovate, striate, with trichomes	cylindrical, glabrous	cylindrical, glabrous	cylindrical, glabrous
Pappus (length)	5–6 mm	4–6 mm	3.5–5 mm	5–6 mm	6–9 mm	6–8 mm

Table 1. Continue

	<i>S. evacoides</i>	<i>S. humillimus</i>	<i>S. expansus</i>	<i>S. trifurcifolius</i>	<i>S. repens</i>
Distribution	PE, BO, AR	BO, South Peru	AR, BO, PE	PE, BO, CH	BO, EC, PE
Altitude	4000–4800 m	3500–4500 m	3900–4800 m	4000–4500 m	3000–4600 m
Habit	suffruticose or shrubby	dense caespitose mat	ground rosette herb	suffruticose	ground rosette herb
Plant dimensions (height, diameter)	2 cm, ca. 1 m	2 cm, ca. 70 cm	2–4 cm, 5–8 cm	5–8 cm, > 8 cm	2–4 cm, 6–9 cm
Indumentum	white lanuginose, < 0.2 mm	puberulous, 0.1–0.2 mm	densely lanuginose, < 0.2 mm	absent	puberulous, < 0.2 mm
Leaf shape	obovate-spathulate	linear-spathulate, ovate	ovate, elliptical or circular, crenate	cuneiform-linear, dentate	elliptic-ovate, obovate
Leaf (length, width)	10–20 × 3–6 mm	3–10 × 0.5–1 mm	10–25 × 10–22 mm	10–20 × 1 mm	10–25 × 10–22 mm
Leaf pubescence	densely lanuginose	sparsely puberulous	densely lanuginose	glabrous	glabrous adaxially, puberulous abaxially
Involucre (shape; length; width)	campanulate; 7–8 × 5–6 mm	cylindrical-campanulate; 5 × 3–4 mm	campanulate; 10–25 × 10–22 mm	campanulate; 8–9 × 6 mm	campanulate; 6–7 × 8–10 mm
Calycular bracts (shape; margin; size)	linear; tomentose; 6–7 × 0.8–1.2 mm	linear; glabrous; 3–4 × 0.7–1 mm	linear; tomentose; 9–22 × 2.5–5 mm	linear, glabrous; 7–8 × 0.8–1.2 mm	linear, glabrous; 5–6 × 0.8–1.2 mm
Phyllaries (shape; size)	linear; 5–7 × 0.8–1.1 mm	oblong-lanceolate; 6–8 × 1–1.2 mm	linear; 10–15 × 2–4 mm	lanceolate, attenuate; 6–8 × 1–1.5 mm	linear; 13–20 mm × 1–2 mm
Phyllaries (number)	13–20	8	20–25	8	13–20
Phyllaries (margins)	pubescent	glabrous	glabrous or pubescent	glabrous	glabrous
Corolla (color)	yellow	dark yellow with purple tube	yellow	yellow	yellow
Achene (shape, texture)	cylindrical, glabrous	cylindrical, sericeous	cylindrical, glabrous	cylindrical-ovate, densely sericeous	cylindrical, glabrous
Pappus (length)	4–6 mm	5–7 mm	10–20 mm	6–7 mm	5–6 mm

homogamous, discoid and pedicled (5–10 mm long). *Involucres* at first narrowly cylindrical becoming cylindrical-campanulate with age (7–9 mm long \times 3–5 mm wide). *Calycular bracts* linear-oblong (6–8 mm \times 0.7–1 mm), dark green on the surface and light green along the margins, with dark brown-black apex covered with inconspicuous trichomes or glabrous. *Phyllaries* 12–14, connate, 5–6.5 mm long \times 0.6–1 mm wide, linear-lanceolate, margins glabrous, apex dark brown with short trichomes. *Florets* 13–16; corolla tubular, abruptly constricted near the base, 5-lobed, each lobe 0.2–0.3 mm long, white, tube 2.5–4 mm long \times 0.5–0.8 mm wide; anthers linear-lanceolate, 1.5–2 mm long \times 0.2–0.3 mm wide, truncate, terminal appendages lanceolate, obtuse; margin whitish transparent and becoming darker towards the centre; style dark purple, truncate, apically covered by papillae equally distributed. *Achenes* cylindrical, pale green, finely covered with trichomes, 1.5–2 mm long \times 0.6–0.9 mm wide; carpodium symmetrical in a shallow ring; pappus of smooth fine bristles, white, 4–6 mm long, with fine alternate single setulae.

Ecology and distribution. Terrestrial plant on bare clayey soils on the summits of mountain peaks and grassland plateaus in the north of the Moquegua Region at elevations of 4550–4800 m. Co-occurring with *Belloa pickeringii* (A. Gray) Sagást. & M.O. Dillon, *Nototriche obcuneata* (Baker f.) A.W. Hill, *Pycnophyllum molle* Remy, *Senecio candollei* Wedd. and *Xenophyllum ciliolatum* (A. Gray) V.A. Funk. Flowers and fruits between March and April.

Etymology. This *Senecio* is named after Karlè Sýkora, a well-known Dutch vegetation scientist who was my mentor in phytosociology.

Additional material examined (paratypes). PERU. Moquegua Region, General Sánchez Cerro Province, Ubinas District, S of Pillone, terrestrial on bare clayey soils in the verges of the road to Pillone town, elevation 4584 m, 16°10'02"S, 70°49'56"W, 24 March 2013, *Montesinos 4023* (USM).

Discussion. *Senecio sykora* appears to be closely related to *S. gamolepis* which grows at higher elevations but approaches the known range of *S. sykora* within a few hundred metres. While *S. gamolepis* is generally distinctive in the genus for its large size, attaining widths of up to 1 meter in diameter, and for its larger, capitulate form, *S. sykora* is a smaller plant, of about 4–6 cm wide and has shorter corolla, less than 9 mm long. *Senecio sykora* is also distinctive in that it has 12–14 phyllaries per capitulum instead of 7–9 phyllaries in *S. gamolepis*. Likely the leaves of *S. sykora* are distinctive in that they are obovate-spathulate vs. linear-lanceolate. Also, the achenes in *S. sykora* are larger (1.5–2 mm long) vs. 1–1.3 mm long in *S. gamolepis*. *Senecio sykora* also differs from *S. algens* by the leaf and capitula length (shorter in *S. sykora*), and from both species by the corolla colour (white vs. yellow). Less similarity is found in *S. algens*, *S. humillimus*, *S. trifurcifolius*, *S. pucapampaensis* and *S. evacoides*, and from which *S. sykora* can be distinguished on the basis of its habit, trichomes, leaf shape and length, calycular bracts and phyllary length and shape as summarized in Table 1.

Conservation status. Following the criteria and categories of IUCN (2001), a preliminary status of Critically Endangered (CR) is assigned. The new species deserves

protection because its total area of occupancy is less than 10 km² (ca. 5 km²) (B2); only one population known (B2b); habitat inferred to be continuing to decline (B2b(i-iii)); population estimated to number fewer than 150 individuals (D). The suitable habitats for *S. sykora* on the mountain summits of the north of Moquegua are indicated as endangered because of overgrazing of grasslands, changes in annual rainfall, volcanic activity, and exploitation of natural resources, all potentially reducing their extent.

***Senecio tassaensis* Montesinos, sp. nov.**

urn:lsid:ipni.org:names:77140251-1

Figs 3, 4C, 5

Diagnosis. Similar to *Senecio moqueguensis* but clearly distinguished by the leaf lamina obovate-spathulate (vs. oblong-spathulate), leaf length 6–9 mm (vs. 8–12 mm), leaf surface densely covered by trichomes (vs. sparsely covered), trichomes 0.3–1.2 mm long (vs. 0.1–0.3 mm long), corolla white (vs. yellow), calycular bracts 4–6 mm long (vs. 6–9 mm), phyllaries 12–16 (vs. 9–12), involucre length 6–8 mm (vs. 7–10 mm), and achene length 1–1.2 mm (vs. 1.8–2.5 mm).

Type. PERU. Moquegua Region, General Sánchez Cerro Province, Ubinas District, NW of Tassa, terrestrial on clayey rocky soils on the summits of Pirhuani peak, elevation 4657 m, 16°09'58"S, 70°43'49"W, 07 April 2011, *Montesinos 3103* (holotype HUSA!, isotypes MOL, USM).

Description. *Perennial* herb, tufted, up to 2–4 cm high and up to 4 cm in diam. *Trichomes* glandular, densely covering the plant, multicellular, whitish transparent, 0.3–1.2 mm long × 0.1–0.2 mm wide, composed of 6–10 ovate or elongate cells (each 60–80 µm long), apical cell rotund. *Stems* thick, < 1 cm long, often densely branched and leafy in the central portion. *Leaves* arranged in irregular rosettes, lamina obovate-spathulate, 6–9 mm × 1–2.5 mm, densely covered by thin trichomes on the margins; base truncated and apex pinnatifid; lower and upper surface of the leaves gradually becoming shorter towards the tip; margin incised with 5–7 obtuse lobes or rarely acuminate; mature leaves with involute margins; young leaves green yellow turning greenish grey with age. *Synflorescences* of solitary sessile or subsessile terminal capitula. *Capitula* homogamous, discoid. *Involucres* at first cylindrical, turning campanulate with age (ca. 6–8 mm long × 5–7 mm wide). *Calycular bracts* ovate-oblong (4–6 mm × 1 mm), greyish green on the surface and covered with trichomes on the margins, dark brown apex covered apically with short brown multicellular trichomes. *Phyllaries* 12–16, connate, 5–8 mm long × 0.8–1.2 mm wide, linear-lanceolate, covered with thin trichomes scarcely on the surface and densely along the margins, apex dark brown and covered with short multicellular trichomes. *Florets* 18–21, corolla tubular, abruptly constricted near the base, 5-lobed, each lobe 0.2–0.4 mm long, purple pink gradually becoming pale white towards the tip, tube 2–2.5 mm long × 1 mm wide; anthers linear-lanceolate, 1.5–2 × 0.3–0.4 mm, terminal appendages lanceolate, acute to somewhat protuberant, bases ecalcarate; anthers margin white becoming dark yellow towards

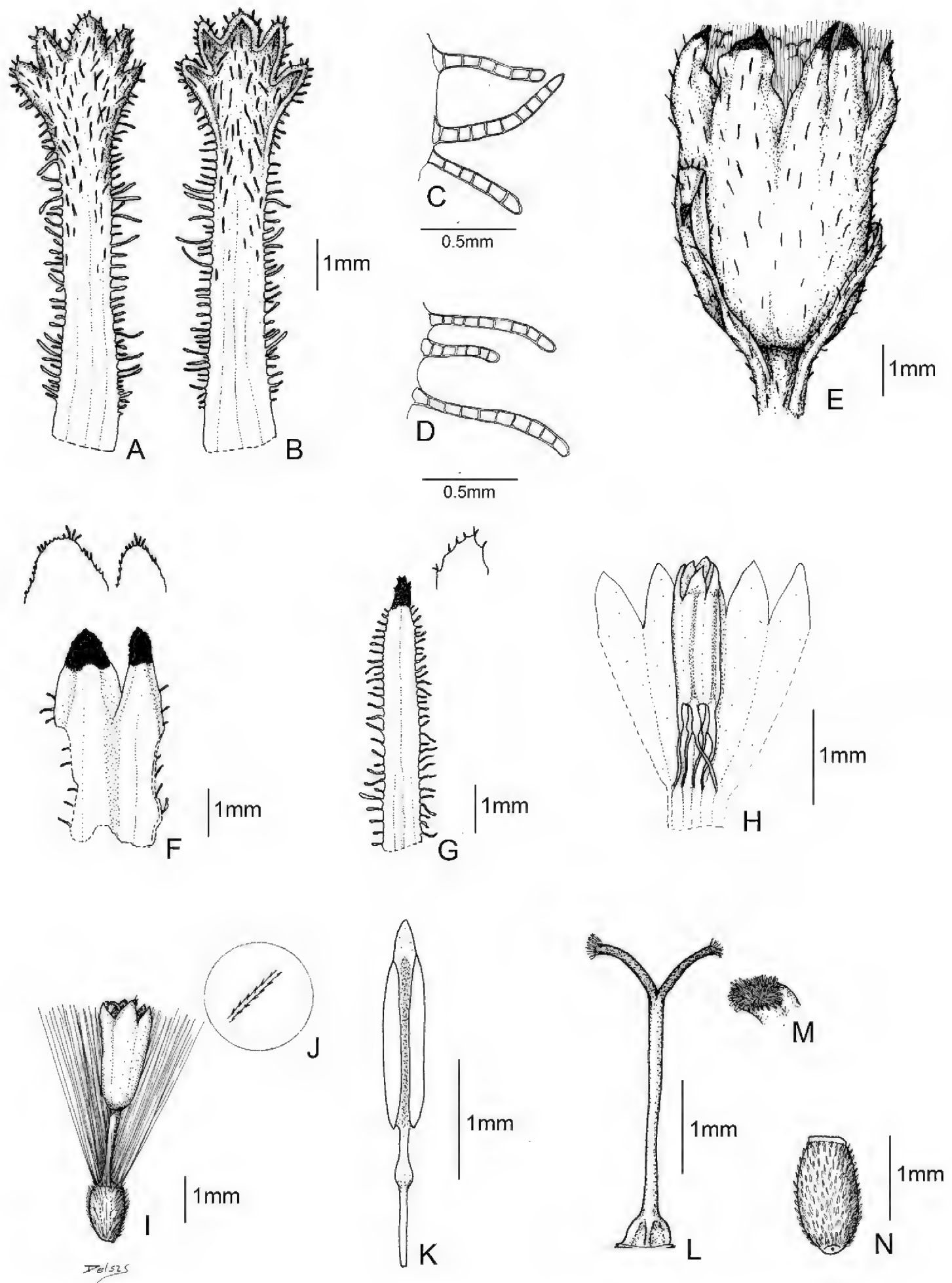


Figure 3. *Senecio tassaensis* Montesinos. **A** Leaf (upper side) **B** Leaf (underside) **C** Phyllaries trichomes **D** Leaf trichomes **E** Capitulum **F** Calycular bracts **G** Phyllary **H** Stamens arrangement in a floret **I** Floret **J** Pappus bristles **K** Stamens **L** Style **M** Papillose stigma **N** Achene.



Figure 4. Habit photographs of: **A** *Senecio moqueguensis* **B** *Senecio sykoraе* **C** *Senecio tassaensis*.

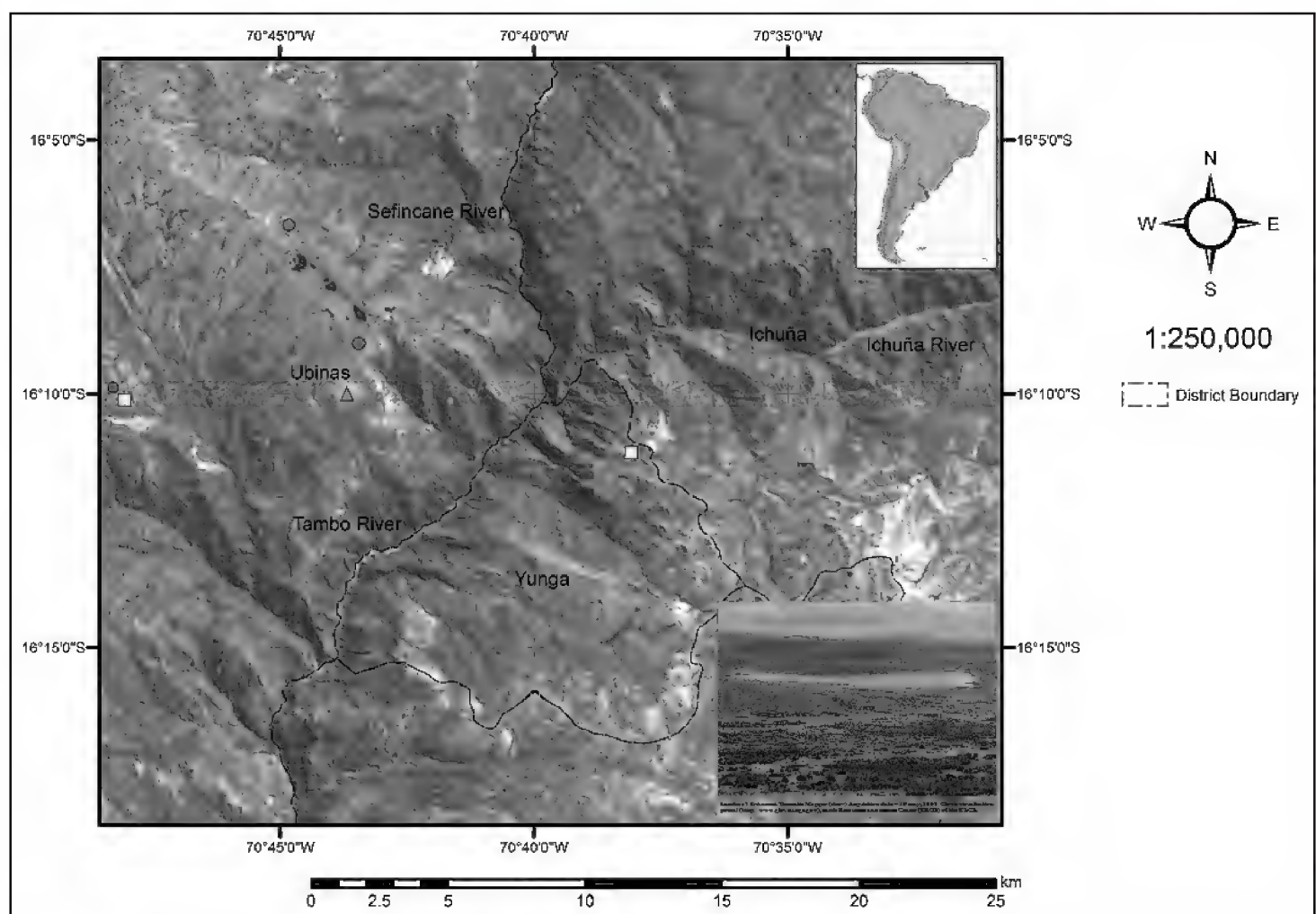


Figure 5. Distribution map showing collection and recorded sites for *Senecio moqueguensis* (red circles), *S. sykoraе* (yellow squares) and *S. tassaensis* (green triangles). Inset: Photograph of the highland plains of Tassa, Moquegua, where populations of *S. moqueguensis* occur.

the centre; style dark purple, truncate, papillae covering the whole surface of the apex. *Achenes* ovate, striate, covered with trichomes, 1–1.2 mm long and 0.6–0.8 mm wide, pale yellow; carpopodium symmetrical in a shallow ring; pappus of smooth bristles, white, silky, 3.5–5 mm long, with fine single setulae.

Ecology and distribution. Terrestrial plant on clayey rocky soils on the peaks of the highland summits of the Pirhuani peak, near Tassa town, Moquegua Region, at elevations of 4650–4700 m. It occurs with *Azorella*, *Calamagrostis*, *Pycnophyllum*, *Mniodes*, *Senecio*, and *Xenophyllum*. Flowers and fruits between March and April.

Etymology. This *Senecio* is named after the town of Tassa (Moquegua Region), downslope of Pirhuani peak where the species was found.

Discussion. *Senecio tassaensis* appears to be closely related to *S. moqueguensis* which grows at the same elevational range but approaches the known range of *S. tassaensis* within a few hundred metres. *Senecio moqueguensis* is generally distinctive in the series for its larger size, attaining dense ground mats, and for its yellow corolla. *Senecio tassaensis* has 12–16 phyllaries (vs. 9–12), an involucre length of 6–8 mm and achene length of 1–1.2 mm, being much shorter than in *S. moqueguensis*. *Senecio tassaensis* is relatively a very rare species with an estimated 100 individuals known. It is less similar to *S. pucapampaensis*, *S. evacoides*, *S. expansus* and *S. repens*, and can be distinguished on the basis of the habit, trichomes, leaf shape and length, calycular bracts and phyllaries length and shape as summarized in Table 1.

Conservation status. Following the criteria and categories of IUCN (2001), a preliminary status of Critically Endangered (CR) is assigned. The new species deserves protection because its total area of occupancy is less than 10 km² (ca. 5 km²) (B2); only one population is known (B2b); habitat inferred to be continuing to decline (B2b(i–iii)); population estimated to number fewer than 100 individuals (D). The suitable habitats for *S. tassaensis* on the mountain summits of Pirhuani peak in the Ubinas district are indicated as endangered, because changes in the annual rainfall, volcanic activity and exploitation of natural resources, may all reduce their extent.

Key to the species of *Senecio* ser. *Suffruticosi* subser. *Caespitosi* in Peru

(adapted from Cabrera 1985, Cabrera et al. 1999)

- | | | |
|----|---|----------------------------|
| 1a | Plants shrubby; involucre longer than 11 mm | 2 |
| 1b | Plants caespitose; involucre shorter than 11 mm long..... | 5 |
| 2a | Achenes densely pubescent; leaves 1–2 cm long, deeply dentate or lobulate ..
..... | <i>S. adenophyllus</i> |
| 2b | Achenes glabrous; leaves 1–3.5 cm long, entire | 3 |
| 3a | Leaves 3–5 mm wide; involucre bracts oblong | <i>S. rufescens</i> |
| 3b | Leaves 0.7–2 mm wide; involucre bracts linear | 4 |
| 4a | Leaves 25–80 mm long; phyllaries 13–18 | <i>S. scorzonerifolius</i> |
| 4b | Leaves 15–25 mm long; phyllaries 15–20 | <i>S. danai</i> |

5a	Capitulum small; involucre shorter than 5 mm.....	6
5b	Capitulum larger; involucre shorter than 11 mm.....	7
6a	Leaves entire, glabrous and fleshy; phyllaries 8.....	<i>S. humillimus</i>
6b	Leaves entire or dentate, glabrous or lanuginose; phyllaries 13.....	<i>S. vegetus</i>
7a	Plants tomentose, at least on the underside of leaves.....	8
7b	Plants glabrous.....	13
8a	Plants with dense pubescence covering all plant parts	9
8b	Plants with sparse pubescence not covering all plant parts.....	11
9a	Leaves spatulate, 10–20 mm long; involucre 7–8 mm tall; phyllaries 13–20	<i>S. evacoides</i>
9b	Leaves ovate, elliptic or circular, crenate, 10–65 mm long; involucre 6–10 mm tall; phyllaries 13–25	10
10a	Involucre 10–25 mm long; phyllaries 20–25	<i>S. expansus</i>
10b	Involucre 6–7 mm long; phyllaries 13–20	<i>S. repens</i>
11a	Leaves cuneiform, lamina glabrous except puberulous margins	<i>S. pucapampaensis</i>
11b	Leaves oblong, lamina with trichomes on surfaces and margins	12
12a	Leaves 8–12 mm long, lamina oblong-spathulate; involucre 7–10 mm; phyllaries 9–12	<i>S. moqueguensis</i>
12b	Leaves 6–9 mm long, lamina obovate-spathulate; involucre 6–8 mm; phyllaries 12–16	<i>S. tassaensis</i>
13a	Leaves dentate, linear-cuneiform.....	<i>S. trifurcifolius</i>
13b	Leaves entire	14
14a	Leaves 10–35 mm long.....	<i>S. algens</i>
14b	Leaves less than 14 mm long.....	15
15a	Leaves 8–12 mm, linear-lanceolate; involucre 8–11 mm; phyllaries 6–8	<i>S. gamolepis</i>
15b	Leaves 9–14 mm, obovate-spathulate; involucre 7–9 mm; phyllaries 12–14 ...	<i>S. sykoraе</i>

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References

- Arakaki M, Cano A (2003) Composición florística de la cuenca del río Ilo–Moquegua y lomas de Ilo, Moquegua, Perú. *Revista Peruana de Biología* 10(1): 5–19.
- Beltrán H (2009) Dos especies nuevas de *Senecio* (Asteraceae: Senecioneae) del Perú. *Arnaldia* 15(2): 211–215.
- Beltrán H, Granda A, León B, Sagástegui A, Sánchez I, Zapata M (2007) Asteráceas endémicas del Perú. In: León B, Roque J, Ulloa C, Pitman N, Jorgensen PM, Cano A (Eds) *El Libro Rojo de las Plantas endémicas del Perú*. *Revista Peruana de Biología. Número Especial* 13(2): 64–164.
- Brako L, Zarucchi J (1993) Catálogo de las Angiospermas y Gimnospermas del Perú. *Monographs in Systematic Botany from the Missouri Botanical Garden* 45: 1–1286.
- Bremer K (1994) *Asteraceae: Cladistics and Classification*. Timber Press, Portland, 1–752.
- Cabrera A (1949) El género *Senecio* en Chile. *Lilloa* 15: 27–501.
- Cabrera A (1955) Notas sobre los *Senecio* sudamericanos, VIII. *Notas Museo de la La Plata, Botánica* 18(89): 191–240.
- Cabrera A (1985) El Género *Senecio* (Compositae) en Bolivia. *Darwiniana* 26: 79–217.
- Cabrera A, Freire SE, Ariza Espinar L (1999) Tribu VIII. Senecioneae. In: Hunziker AT, *Flora Fanerogámica Argentina* 62. Museo Botánico de Córdoba, Córdoba, 3–164, 171–179.
- IUCN (2001) *IUCN Red List Categories and Criteria: Version 3.1. Second Edition*. Gland, Switzerland and Cambridge, UK.
- JSTOR (2013) JSTOR Plant Science <http://plants.jstor.org/> [accessed 15.12.2013]
- Montesinos D (2011) Diversidad Florística de la cuenca alta del río Tambo–Ichuña, Moquegua, Peru. *Revista Peruana de Biología* 18(1): 119–132.
- Montesinos D (2012) Lista anotada de nuevas adiciones para la flora andina de Moquegua, Perú. *Revista Peruana de Biología* 19(3): 303–312.
- Neotropical Herbarium Specimens (2013) The Field Museum <http://fm1.fieldmuseum.org/vrrc/> [accessed 15.12.2013]
- Nordenstam B (1977) Senecioneae and Liabeae—systematic review. In: Heywood VH, Harborne JB, Turner BL (Eds) *The biology and Chemistry of the Compositae*, vol. 2. Academic Press, London, 799–830.
- Nordenstam B, Pelser PB, Kadereit JW, Watson LE (2009) Senecioneae. In: Funk VA, Susanna A, Stuessy TF, Bayer RJ (Eds) *Systematics, Evolution and Biogeography of Compositae*. International Association for Plant Taxonomy, Institute of Botany, University of Vienna, 503–521.

- Pelser PB, Nordenstam B, Kadereit JW, Watson LE (2007) An ITS phylogeny of tribe Senecioneae (Asteraceae) and a new delimitation of *Senecio* L. *Taxon* 56(4): 1077–1104. doi: 10.2307/25065905
- Roque N, Keil DJ, Susanna A (2009) Illustrated glossary of Compositae. In: Funk VA, Susanna A, Stuessy TF, Bayer RJ (Eds) *Systematics, Evolution and Biogeography of Compositae*. International Association for Plant Taxonomy, Institute of Botany, University of Vienna, 781–805.
- Tropicos.org (2013) Missouri Botanical Garden <http://tropicos.org> [accessed 15.12.2013]
- Vision TJ, Dillon MO (1996) Sinopsis de *Senecio* L. (Senecioneae, Asteraceae) para el Perú. *Arnaldoa* 4(1): 23–46.